

Managing Project During Uncertainty - A Case Study of the COVID-19 Pandemic

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Abstract: *This study investigated the challenges encountered by project managers and other stakeholders during COVID-19 and the strategies to achieve sustainable project delivery during this period of uncertainty. A qualitative research method was used. Data was collected from 50 stakeholders in the construction industry in the US. The data was collected through interview. Thematic analysis was used to analyze the data from the interviews. Findings from the study showed that Project managers and stakeholders in the US are encountering operational and financial challenges due to COVID-19. The study showed that construction projects are affected by health and safety issues, increase in the price of materials, shortage of labor and material supply, reduced profit, delays in project, etc. Also, the study indicates that, in order to tackle COVID-19 challenges, Project managers and stakeholders are adopting managerial, governmental and stakeholder's strategies. At management level, the focus is on improving the health and safety of construction workers as a result of COVID-19. The study further echoes the need for government and clients to provide loan, funding, and incentives to assist Project managers and other stakeholders in supporting staff payment and exceeding cost towards project completion. Significant ways to achieve this is by introducing incentives programs, overtime, and grants. Based on these findings, the study thematically drew the conclusion that COVID-19 have caused operational and financial challenges; therefore, it is recommended employing managerial governmental and stakeholders' strategies to achieve effective project delivery during period of uncertainty in the US.*

Keywords: COVID-19 pandemic, Challenges and strategies, Project delivery, Thematic analysis

1. Introduction

The rationale for conducting this research is due to the destructive impact of the coronavirus situation on projects globally. Most infrastructure projects had to be stopped due to the coronavirus pandemic, which was causing major delays and had also put into question the possibility of the survival of many projects that were seen as being instrumental for the transformation of the economy.

Additionally, the fear of external events has created an environment in which project managers have to be fully aware of expected implications. Even though the coronavirus situation was outside of the construction industry, it is still expected to have an impact on a frequent basis. In the future, the types of viruses which are expected to impact economies will also change requiring project managers to remain flexible and take lessons from the current coronavirus situation and the handling of projects.

COVID-19 is the mostly talked topic in all over the world in recent. Reported from the Chinese city of Wuhan, at the end of 2019, the outbreak has hit almost all the countries, (Emshk, 2020). The pandemic situation is a first for many stakeholders in a very long time. This has created many different panic reactions from stakeholders, eventually causing delays in the projects which were announced. It goes without saying that cancellation of projects has a dominant effect on the economy, as the construction sector provide one of the highest levels of output to any economy, (Alsharif et al, 2021). As such, it is important to understand what some of the reasons are which are causing these delays, and what project managers can be doing to stem the issue

which arises out of these delays. Delays are extremely costly, and projects have to either cut down resources or cut down the quality of materials to be able to make the deadline within the given budget.

The pandemic had positive and negative impacts on the productivity of multiple jobs. The overall negative impact surpassed the positive effects of the pandemic. In this study, the challenges encountered with project managers are divided into operational and financial challenges. The operational challenges include shortage of labour supply, low patronage, project delay, inadequate supply of materials, management difficulties and health and safety issues. The financial challenges include increase in materials and construction cost, payment delay and reduction in profits making.

Thus, these questions arise: what are the challenges faced by project managers during the COVID-19 period and how do project managers manage projects during this uncertain period?

The aim of this study is to examine the challenges faced by project managers during the COVID-19 period and how they manage projects during this uncertain period. This study is structured into five sections. Section one is the introduction, section two contains the literature review, section three focuses on the methodology. Section four, analyzed the data collected while section five is the conclusion and recommendations.

2. Literature Review

The COVID-19 pandemic has had a profound impact on the management of projects in various industries worldwide. The pandemic introduced a level of uncertainty that many organizations had not experienced before, forcing them to adjust their project management strategies.

Danila and Adam (2020) examined the challenges in project management during the COVID-19 crises. This paper presented the context, the situations encountered, and the measures taken by the managers in projects financed under the European Union Operational Program Human Capital followed by the recommendations. According to the authors management type is a more significant factor between success and failure than ever before. Some managers succeed to convert the risks to opportunities and some, on the contrary, increase the threats and the uncertainties. Their research focus was on how the manager's deal with the World Health Organization recommendations on social distancing while the experts involved in the project must be in constant contact with the target group. Also, they evaluated how the Romanian public institutions responsible for Operational Program Human Capital reacted to the Coronavirus (COVID-19) disease pandemic. They analyzed, on one hand, the cases in which were considered more beneficial for a delay of the activities to respect the safety measures and, on another hand, the cases in which the activity continued online. They identified the factors that had either a positive or negative impact on both categories of projects, the grade in which the project managers were aware of them, and their decisions. For the projects that are implemented exclusively online, they asked the managers how difficult was to find the most efficient online work tools, how fast occurred the change, how reluctant the experts were at the beginning, and how sustainable is their new way of implementing the projects. Moreover, they assessed the capacity of the manager to maintain the project team united and to motivate his colleagues to achieve the project objectives. Another important aspect followed were some patterns in financial management, with a highlight on how the managers redistributed their financial resources for the next months.

Shamim (2022) investigated the effects of COVID-19 on project management processes and practices. The main goal of this research is to identify and determine the effect of the COVID-19 outbreak on the Management of projects. The global pandemic affected work-related processes, straining employees working on projects as a team. The number of activities that must be coordinated and managed during the pandemic can overwhelm the management team. This event makes it essential for proper planning by the organization's leadership team. However, making quick and correct decisions can be challenging due to the abrupt changes experienced in different sectors of the global economy.

Krishnan, Ajithkumar, Manishankar, Upendra, Kabilanand Muralidhar (2021) analyzed the importance of project portfolio management and the risks associated with it in the construction industry taking into account the impact of novel corona virus COVID-19. This research identifies the adoption of more consistent project governance, risk

management techniques and way more careful project portfolio management as the core area of study. A conceptual framework for Project Portfolio Management is also designed after analyzing various parameters of Project Portfolio Management of construction industry with the help of Bayesian framework. The key motive for undertaking this part of examination on real estate sector of Indian construction industry in southern part of India to reduce the impacts and increase the return on investment from the projects by mitigating the effect of risk factors associated in the projects. Project Portfolio Management tools and techniques are very useful for managing multiple construction projects.

Waheeb, Wheib, Andersen and Al-Suhiili (2022) discussed risk management strategies caused by pandemic-related (COVID-19) suspensions in thirty-six engineering projects of different types and sizes selected from countries in the middle-east and especially Iraq. The primary data collection method was a survey and questionnaire completed by selected project crew and laborers. Data were processed using Microsoft Excel to construct models to help decision-makers find solutions to the scheduling problems that may be expected to occur during a pandemic. A theoretical and practical concept for project risk management that addresses a range of global and local issues that affect schedule and cost was presented and results indicated that the most significant delays are due to a lack of good project risk management skills and remote project management capability which is exacerbated by shortfalls in technical development and information technology.

Hemadoshini (2021) examined how to mitigate the impact of COVID-19 in managing project. To explore this, a quantitative study with 100 participants was carried out. The variables under study included looking at methods used for project management, human resource factors and their organizational approach, the impact on key success factors and how delays have impacted these project execution techniques. The results indicated that the variables used have all impacted project execution, indicating their importance during this unprecedented period. With these findings, project team members and organizations can start developing systems which can mitigate the external risk and its transfer onto projects, something which has come full force in the current business environment. There were several key findings which were part of the current study. The current study looked at for different variables and their impact on how projects were being executed, and the results indicated that all the factors including the impact of delays, key success factors, methods used, as well as human resource up skill were all significantly correlated with the variable. This clearly indicates, the project team members will face differential headwinds as they go into this coronavirus situation, which then requires them to influence the way they carry out their projects, requiring them to tweak important factors around how the project execution takes place.

2.1 Challenges faced during the COVID-19 pandemic

As a result of COVID-19 having a tremendous negative impact on project performance, relevant literature (Isang and

Ebiloma, 2022; Gamil and Alhagar, 2020; Kabiru and Yahaya, 2020; Pamidimukkala and Kermanshachi, 2021) have identified some of the challenges faced by construction professionals. Pamidimukkala and Kermanshachi (2021) identified categories of COVID-19 challenges, with the result revealing, lack of a safe environment in the workplace, heavy workloads, home situations and concerns about job stability as contributing factors that management encountered with their construction workers. Bailey et al. (2020) observed supply chain disruption, labour shortage, financial constraints, health and safety concerns, changes in project requirements, uncertainty and unpredictability, and communication barriers as the challenges faced by construction project management professionals due to the impact of COVID-19.

On the contractual side, Gamil and Alhagar (2020) noted that contractors in Malaysia are inevitably faced with legal issues due to the nonconformity of contractual terms, which is caused by the suspension of the project and sudden fluctuation of material price. Kabiru and Yahaya (2020) revealed that contractors and employers in the construction industry are affected with site work activities, the bill of quantities, project completion, law of contract, causing Force Majeure events in the Nigerian construction industry. This poses a difficult challenge to stakeholders.

Osuizugbo (2020) revealed that transportation problem (for both materials and workers), project abandonment, delay in construction activities, high cost of construction materials, reduction in working hours per day, lack of funding and shortage of workforce were among the disruptions in the Nigerian construction sector during the COVID-19 pandemic. Ozili (2020) attributed the severity of the pandemic in Nigeria to weak institutions, and a lack of adequate social welfare packages to swiftly cushion the effect of the pandemic. Yusuf et al. (2021) found that the COVID-19 pandemic has led significantly to project cost overrun, project time overrun and litigation arising from construction disputes.

2.1.2 Strategies adopted by Project managers during period he pandemic

Some studies identified several strategies that project managers used to manage their projects during the COVID-19 pandemic. Ahmad, S., & Khuwaileh, A. A. (2021) conducted a case study on Agile Project Management during COVID-19. The study aimed to explore how agile project management (APM) practices could be adapted to manage projects during the pandemic. The study found that APM practices such as iterative development, continuous delivery, and collaboration helped project teams to adapt quickly to the changing project requirements and mitigate the impact of COVID-19 on project timelines and quality. The study also identified the importance of effective communication and the use of digital tools in facilitating remote work and collaboration.

(Choudhury, T. A., & Ahmed, A, 2021; Liu, H., Liu, H., Chen, Y., & Fan, J. 2020) conducted an analysis of the impacts of the COVID-19 pandemic on construction projects and possible mitigation measures. The studies recommended several strategies, including increasing communication with

stakeholders, leveraging technology to facilitate remote work, redefining project goals and timelines and adopting agile project management methodologies.

Maqbool, S., Bashir, F., & Kamran, A. (2021) conducted an empirical study on the impact of the COVID-19 pandemic on project management in the construction industry. The study discovered that adopting lean construction practices such as reducing waste, increasing efficiency, and improving collaboration among team members to enable project teams to respond quickly to changing project requirements and mitigate the impact of the pandemic on project timelines and quality.

Permesly et al. (2021) opined that: installing hand sanitizer stations; mounting center for disease control (CDC) posters emphasizing the importance of washing hands and covering faces with masks; mandating thermal screening for everyone entering and leaving the facility are health and safety preventive measures that can be made. Ogunnusi et al. (2020) opined that construction companies that are adopting and implementing technology are gaining the rewards (especially in this COVID-19) with better collaboration, increased productivity, and project completion under budget and on time leading to increased profit margin.

2.2 Solving project management Issues during and after the outbreak of the pandemic Managerial strategy

2.2.1 Clear communication strategy and project team collaboration

The measures taken by the government forced employees to work remotely. This change ended regular physical status meetings preventing daily interactions with colleagues in their respective offices. This scenario made it challenging to seek clarifications on specific issues related to the organization's projects which therefore presented an opportunity to adopt other forms of communication. As a result, it became essential for organizations and project teams to create virtual teams, making it possible for them to feel connected and keep in touch regularly. Most organizations reduced the number of emails sent internally (Shamim, 2022). These organizations adopted chats for issues that did not need extensive insights due to the little time taken to get a response from other team members. Using chats also reduces constant phone calls and allows project members to manage their working schedules and respond to inquiries on their own time (Tripiawan & Frestikawati, 2021).

Most project teams adopted video conferencing tools such as zoom and Googled hangouts to hold regular meetings. These conferencing tools were vital in the recreation of conference room atmospheres, facilitated communication between team members, and helped in the maintenance of team member connections which reduced the effects of feeling isolated as a result of working from home. Furukawa (2016) explains that constant communication helps project managers quickly identify emerging issues and offer viable solutions. This scenario makes it possible for the project team to meet the deadline within the allocated budget.

2.2.2 Centralization of Data

The lockdowns due to the pandemic made it necessary for organizations to centralize information, including communication channels, reports, and other documents vital to attaining the organization's project goals. Different teams in a project often use other forms of data to achieve the project's end goal. This case makes it a primary need to be in a position to collect and synchronize the various data sets. The lack of a centralized information system makes Management of a project demanding and increases the chances of failing to achieve the goals set by the organization (Cogburn, 2005).

According to Müller and Klein (2020), project management tools enable managers to log in and access what happens on a given project in real-time. The managers can also track the status of every project and ensure everything takes place as planned. Google Drive is one of the collaborative tools adopted by most organizations. Failure to use these tools often led to wasting time while trying to access documents in different individual project folders. Centralization of data and resources ensures all members involved in the project are aware of their responsibilities, tasks assigned to them, and the deadlines to deliver (Shamim, 2020).

2.2.3 Efficient and effective monitoring

Like data centralization, the pandemic has forced project managers to monitor the project's progress more closely. Most organizations try to avoid extra costs, deadline delays or missing vital resources that would compromise the company's return on investment at the end of their financial year (Mousa Eltoun et al., 2021). Therefore, close monitoring is necessary to ensure effective and efficient Management of the entire project. Adopting and implementing an effective centralization tool makes it easier for the project team to get an efficient report. Both monitoring and centralizing tools should work in synchronization to facilitate accurate time information, enabling team members to take appropriate actions when needed.

These factors are interconnected. The absence of efficient communication makes it difficult for project managers to act on emerging issues despite having the freedom and capability to monitor the project's progress. The lack of information centralization makes monitoring incomplete or wrong data less valuable. It is not easy to achieve project goals where the project members are not connected, given the necessary support and empowerment to ensure the progress and success of the project. Successfully implementing these three factors helps organizations and project teams weather the pandemic's effects and provide the organization's long-term productivity (Sánchez, 2016).

2.2.4 Project Risk Management Process

Project risk management is considered as one of the key knowledge areas in project management. PMBOK explains project risk as an uncertainty that can have a negative or positive effect on meeting project objectives, (PMI, 2013).

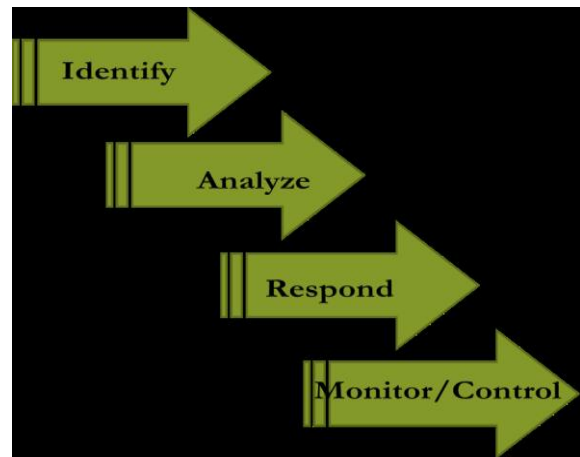


Figure 1: Risk Management Process

Source: PMI 2013.

Choudhury, T. A., & Ahmed, A. (2021) authors argued that project managers were not fully prepared for the COVID-19 pandemic and its impacts on project management, including the need for remote work, changes in project goals and timelines, and communication barriers. The first thing project manager needs to do now is include the potential of a pandemic risk in their risk registers and then begin the risk management process as illustrated in figure 1.

Identifying Risk

The risk may be identified and analyzed in different scenarios. Starting from the least impact possible to worst case scenario and try to find out most influential factors. In project management, risk identification is done in many ways; Brainstorming, Checklists, Interviewing, SWOT Analysis (strengths, weaknesses opportunities, threats), Delphi Technique (anonymous consensus building) or Diagramming Techniques such as Cause & effect, Flow Charts, Influence Diagrams, (Mcholes, 2001).

Risk Analysis

Risk Analysis process try to identify, assess, and sort the most influential factors that may be considered as high-risk factors. Risk analysis assess probability, seriousness, and urgency of each risk and quantification tools and techniques such as; Probability/Impact Matrixes, The Top Ten Risk Item Tracking, Expert judgment are used find the most critical risk factors, (Mcholes, 2001).

Most influential factors for project failure due to COVID-19 crisis identified in this study are,

- 1) Operational challenge (health and safety issues, freedom of movement, supply chain disruption)
- 2) Financial challenge

Hillson (2002) explains a risk breakdown structure that is like work breakdown structure (WBS), commonly used tool in project management. The aim of the work breakdown structure is to present project work in hierarchical, manageable, and definable packages to provide a basis for project planning, communication, reporting, and accountability. In the same way, risk data can be organized and structured to provide a standard presentation of project risks that facilitates understanding, communication, and

management, (Hillson, 2002). Therefore, main risk factors could be further analyzed using a risk breakdown.

Table 1: Risk breakdown structure

Level 0	Level 1	Level 2
Project Risk (Schedule overrun, cost overrun, scope variation, customer unsatisfaction)	Health	<ul style="list-style-type: none"> • Project team infected with COVID-19 • Some members may be infected and total strength not available. • High costs for health and safety • Coordination with other sub-contracting units
	Financial issues	<ul style="list-style-type: none"> • Delay in receivables • Client in financial crisis • Overdue salary and other payments • Increased costs due to safety and health
	Freedom of movement (transportation)	<ul style="list-style-type: none"> • Complete lock down • Provincial/district barriers • Unavailability of transportation modes
	Supply chain disruptions	<ul style="list-style-type: none"> • Shortage of raw material • Higher inventories • Higher cost • Higher lead time

These risk factors may be further decomposed and may get a detailed risk breakdown structure. The risk breakdown structure may use to assign responsible persons in each sub level and identified risk categories, (Hillson, 2002). However, this paper considers most influential four factors in the pandemic and its most recent level.

Identifying and analyzing risks will lead to make an important decision on three key possibilities.

- Whether the project will be operational throughout the crisis.
- Whether project will consider on specific deliverables only.
- Whether the project will be freezed or cancelled.

Responding to Risk

When responding to identified, assessed risks, management actions should be specific to reduce likelihood or impact, depending on management’s agreed-upon risk tolerance and the strategic needs of the business. The most common risk responses include avoid (get out), accept, or retain (monitor), mitigate (institute controls) and transfer or share (partner with someone). (Kastenschmidt, 2020). However, the flexibility of responding to prevailing risks are very much restricted in this pandemic situation. There will be no possibility of avoiding the risk when the existing projects are considered. Most relevant responding methods for this situation will be accepting the risk and risk mitigation.

Monitor/ Control of Risk Management Process

Monitoring and controlling is a continuous process. Identified risk mitigation procedures should be adapted by the project manager in a controlled and monitored environment. This process consists of two components:

- Communicate
- Frequent update

Clear precise, consistent, and transparent communication protocols with project team, clients and other authorities is essential in this crisis to boost up of all the stakeholders and to make sure project is at minimum risk. Proper and continues updates; initially daily updates, then weekly and

when the condition is improved, biweekly updates to all project team and other stakeholders are suggested.

In addition, refresh risk analysis and consider using simulation tools to assess potential cost and schedule outcomes at various confidence levels would be safer and more suitable for sustainable risk management process, (LLC, 2020).

2.2.5 Agile project management

One concept which has been applied successfully within many different contexts is that of using agile methodology with project management techniques. Agility bring strength within the project management framework as it makes it easier to incorporate any changes which can take place during the process, even as the process is executed. This methodology has been confirmed to be in the literature as bringing value to organisations by making the supply chain more effective as well (Atherton, et al., 2007). A project management perspective, it also allows the incorporation of feedback within the communication loop which then also adds an extra layer of robustness on the system that the company is trying to execute. The goal is to execute projects within short sprints, and to understand what the needs of the organisation are to be able to complete that within a specific time frame.

2.2.6 Governmental strategy

Financial aids

Financial aids and provision of incentives should be provided to the contractors by the government to relief them of the resulting financial burden of the pandemic.

2.2.7 Stakeholder’s strategy

Stakeholders’ engagement

Stakeholders in project management are the people who directly or indirectly influence and are affected by the initiation, execution, and implementation of the project. Every project regardless of its type and stage has internal and external stakeholders. Internal stakeholders include people within the organization involved in project delivery such as project manager, team members, company owners, internal sponsors, etc. On the other hand, external stakeholders are people who can influence or be affected by

the project and who don't belong to the organization initiating the project. They include consultants, customers, government, investors, local communities, suppliers, etc. Proper stakeholder engagement ensures risk-free project delivery and timely delivery within the budget, (HKJ, 2017).

3. Methodology

This study adopted a qualitative research design with the use of face-to-face oral interviews and phone calls. The qualitative approach was used to gain deeper insight, through a series of interaction, into the challenges stakeholders experienced as a result of COVID-19 and the strategies they employed to achieve sustainable project performance post-Covid. The source of empirical data was collected with the help of 50 interviewees' using convenience sampling technique. The 100 interviewees were selected based on their knowledge and expertise in executing construction projects. Convenience sampling technique was adopted due to the availability of the sample population. 50 respondents gave the required information this was as a result of accessibility criteria.

The in-depth interviews were conducted with stakeholders in the construction sector in the United States of America comprising of Contractors, Consultants and Clients. The respondents were selected due to their experience in sustainability practices and direct involvement in on-going construction projects. Two questions were asked based on the research objectives: What challenges did you encounter in project management because of the COVID-19 pandemic? And What strategies have you employed to address these challenges to achieve effective project delivery? The study used thematic analysis to examine the responses provided by participants in the field. In using thematic analysis, themes and sub-themes were thus generated to analyze the field data (Braun and Clarke, 2006). Thus, an inductive analysis of participants' experiences by a qualitative research approach (Shank, 2006) was used. The thematic analysis was conducted by transcribing the audio recordings manually, through intelligent verbal transcription

of the interviews and phone calls into written form. Thorough and repeated listening was applied to achieve this. Coding was then carried out by highlighting the notes on Microsoft word application. Themes and sub-theme were thereafter generated by searching, reviewing and defining the coded thematic text. The extracted data was finally analyzed, and the findings were reported. This method assisted in making sense of the qualitative data. Descriptive statistics of percentages were also used to present the data and complement the thematic analysis. Figure 1. shows a flow chart of the methodology employed for the study.

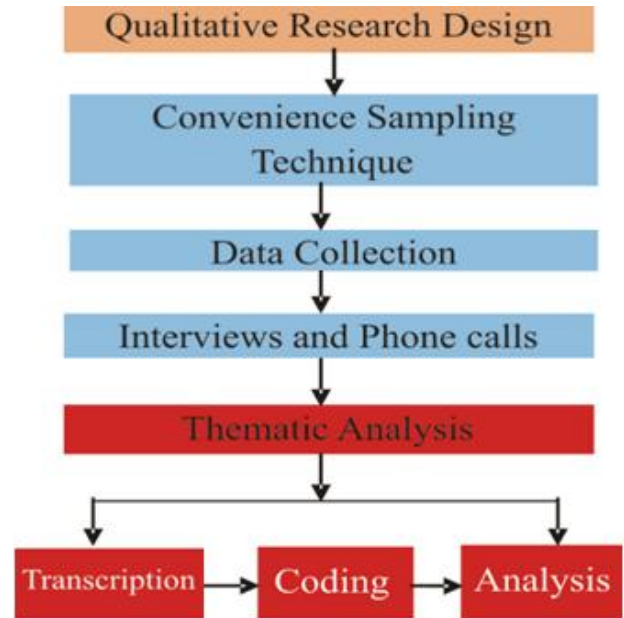


Figure 1: A flow chart of the methodology employed for the study.

Operationalizing and measurement

To operationalize the factors which have been chosen, there will be a combination of existing literature as well is direct questions which have been derived from existing literature.

Table 3-1: Challenges faced by project managers during COVID-19

Type of challenges	Author/Date	Questions
Health issues	(Hillson, 2002)	1) Some project team members were infected with COVID-19 virus
Financial issues	(Hillson, 2002)	2) Several clients had financial issues during the pandemic
Freedom of movement	(Hillson, 2002)	3) Lack of transportation was a barrier. 4) Complete lock down hinders free movement
Supply chains disruptions	(Hillson, 2002)	5) The pandemic made raw materials to be costly.

Table 3-2: Key Success Factors in Managing Projects during Pandemic

Key success factors	Author/Date	Questions
Clear communication strategy and project team collaboration	(Shamim, 2022)	1) Creation of virtual communication enhances effective communication during the pandemic. 2) Video conferencing enhance effective communication between team members
Centralization of Data	(Coggburn, 2005)	3) Centralization of data is important for project execution. 4) Centralization of data ensures that all team members deliver their tasks on time
Efficient and effective monitoring	(Mousa et al, 2021)	5) Efficient and effective monitoring ensures project management success during uncertainty
Project Risk Management Process	(PMI, 2013)	6) Risk management enhances successful project delivery during pandemic
Agile project management	(Atherton, et al 2007)	7) Agility makes it easier to incorporate any changes which can take place during the process, even as the process is executed.
Stakeholders' engagement	(HKJ, 2017)	8) Stakeholder's engagement ensures timely and risks free project delivery.

4. Analysis and discussions of findings

4.1 Demographic data of respondents

Respondents' characteristics	No.	Percentage
Profession:		
Project manager	9	18
Builder	7	14
Engineer	5	16
Quantity surveyor	15	30
Consultant	8	16
Clients	6	12
Total	50	100
Qualification:		
PhD	12	24
M. Sc	25	50
B. Sc	13	26
Total	50	100
Years of experience:		
Contractors	15	12
Consultants	20	16
Clients	125	100

Table 4.1 above presents the demographics of the respondents in terms of their profession, academic qualification, and years of work experience. An in-depth look at the table indicates that 18% of the respondents were Project managers, 14% were Builders, 10% were Engineers, 30% were Quantity Surveyors, 16% were Consultants while Clients recorded 12%. This result implies that stakeholders in the built environment were the respondents in the study with Quantity.

Surveyors representing the major figure head on construction projects. Moreover, the table also shows that majority of the respondents have adequate educational qualification to participate in the study with 50% possessing a M. Sc. degree. Further analysis in Table 4 also reveals that the combined working experience of the Contractors, Consultants and Clients in the built environment were 125 years. This generally implies that the interviewees had adequate experience to make meaningful contribution to the research.

4.2 Challenges encountered on project construction as a result of the COVID-19 pandemic.

COVID-19 has had devastating effects on construction projects. To achieve the objective of examining the challenges encountered by stakeholders in Project management in the USAs a result of the COVID-19 pandemic, the interviewees were asked the challenges they encountered. Their responses were thematically categorized into two themes, which are operational and financial.

4.2.1 Operational challenges encountered on project construction during COVID-19 pandemic.

Certain operational challenges such as shortage in labour supply, inadequate supply of materials, health and safety issues, project delay and low patronage and management difficulties were encountered. According to a Quantity Surveying Contractor interviewed, it was difficult for

contractors to recruit skilled and unskilled labour to work on site during the COVID-19 pandemic. A consultant interviewed further added that workers who relocated, withdrew, or lost their lives during this time and could not be replaced resulting in low workforce. It was also mentioned that they lacked occupational safety health (OSH) staff during this period. Issues of health and safety of workers also posed challenges to the building construction workers during the pandemic. A Mechanical Engineer interviewed alluded to the difficulties in protecting the workers from exposure to COVID-19 infections, because construction work entails interpersonal contact, thereby making it difficult to maintain physical distancing on construction site. Further to this, there was also the challenge of project delay and low patronage. A Project Manager voiced out that project delays were caused by setbacks in delivering materials to construction site due to the restriction of movement. He also added that the difficulty in recruiting workers during the pandemic led to shortage of workers and temporary closure of the construction site, as well as reduction in the operational time. This also caused delay in project execution.

Speaking on low patronage, one of the Contractor, A Quantity Surveyor, revealed that there was reduction in the number of projects they were awarded during this period compared to the pre-Covid era. Contractors also faced challenges in project management during the COVID-19 pandemic. A Quantity Surveyor articulated that it was difficult to manage and supervise project remotely because construction project management requires the physical presence of the contractor/supervisor on site. Another Project Manager interviewed noted that the inability of contractors to move about freely because of the restriction in movement, reduced the efficiency of the workers on the worksite making project supervision difficult. A Client also lamented that his inability to supervise his project during the pandemic gave room to the contractors to use sub-standard materials to gain undue profit. There was also the challenge of inadequate supply of materials during the pandemic. A Building Contractor interviewed alluded to the restriction in movement affecting the supply of materials into the worksite which affected project construction during this period. Apart from the operational challenges, stakeholders also faced financial challenges in building construction project during the COVID-19 pandemic. These are highlighted in the next sub-theme.

4.2.2 Financial challenges encountered on project construction during COVID-19 pandemic

The COVID-19 pandemic was also accompanied by financial challenges such as increase in materials and construction cost, reduction in profit and payment delay. Speaking further on the hike in the prices of materials and the resultant high construction cost, a Project Manager and a Quantity Surveyor interviewed lamented that there was an increase in the cost of both human and material resources in the construction site which caused delays and increase in construction cost. In addition, the contractors explained that their profit on building construction projects reduced drastically compared to the pre-Covid era. Another Construction Manager added that it is now extremely difficult to claim their compensation; this has resulted in

reduction in their investment. As told by a Quantity Surveyor interviewed, they now experienced budget deficit which have led to abandoning of project.

Finally, delays in paying the contractors which invariably led to delay in paying the workers on the site is another challenge confronting building construction as a result of the COVID-19 pandemic. The Contractors as well as a client alluded that insufficient cash flow has resulted in delay in the payment of remuneration to the construction workers.

Despite these challenges, the study shows that Contractors and Clients are still managing to execute building construction projects. Therefore, the next theme focuses on the strategies employed by project managers to manage projects during this uncertain period to enhance sustainable project performance.

4.3 Strategies employed by project managers to manage projects during this uncertain period

For the purpose of developing strategies to address the COVID-19 challenges, the interviewees were also asked the strategies they employed to achieve sustainable project performance. Insights from their response were thematically categorized into three themes which are managerial, contractual, and governmental strategies.

4.3.1 Managerial strategies employed by project managers

Applicable managerial strategies were put in place by the interviewees to overcome the challenges associated with COVID-19 pandemic and ensure sustainable project performance. These strategies include promotion of health and safety, taking market survey and bulky purchase, adequate supervision, working remotely, application of technological innovation, strategic procurement, joint risk management and adherence to COVID-19 protocol. While talking about promotion of health and safety, a Contracting Quantity Surveyor interviewed articulated that they created safety consciousness in their workers and ensured adherence to safety protocols such as cleanliness. One of the interviewees, a consultant, added that safety personnel had been trained to educate the site workers. In order to address the increase in the price of building materials, the Contractors undertook market survey to ascertain the current price of materials needed before carrying out their quotations and the actual purchase. They also noted that they bought in bulk to save cost. Another unique strategy employed by the Interviewees was working remotely and making use of technology. According to a Mechanical Engineer, they currently engage in online contact than physically by using zoom application and other online platforms to hold virtual meetings. Furthermore, they used the pandemic period to strategize how to use technology to augment the activities of workers for better productivity. Also, Building Contractors asserted that they normally employ strategic procurement method such as collaborative procurement, in which the concerned contractor collaborates with other contractor (s) to receive procurement at an affordable rate. Joint risk management and adequate supervision were other strategies highlighted by another Construction Manager interviewed. According to a Quantity

Surveyor, they provided hand sanitizer and nose mask for their workers on the worksite, and they ensured compliance. Also, a client voiced that they ensured the activities of the workers were closely monitored and supervised in the construction worksite. In addition to the managerial strategies put in place by the interviewees, stakeholders also employed contractual strategies to address the COVID-19 challenges. This is highlighted below.

4.3.2 Governmental strategies employed by project managers

Financial aids and provision of incentives were the two key governmental strategies the interviewees noted would ensure sustainable project performance. As told by the interviewees, relief funds should be provided to the contractors by the government to relieve them of the resulting financial burden of the pandemic. A Quantity Surveyor further articulated that the government should give them the opportunity to access grants and loans, so as to keep their operation running in the worksite, pay their workers' salaries and support the project cost. Further to this, other interviewees noted that incentives should be provided to the workers on site to motivate them and ease the burden of the pandemic. The interviewees further employed stakeholder's strategies to address the challenges they experienced as a result of COVID-19. This are highlighted below.

4.3.3 Stakeholder's engagement strategies

While talking about stakeholder's engagement, a Project manager interviewed stressed that they consulted the key stakeholders during the pandemic so as to enhance timely delivery of projects. A Quantity Surveyor interviewed revealed that after consulting key stakeholders, they were advised to review the budget of their construction projects. He added that they revisited the budget of projects they had prior to COVID-19 and reviewed it upwards to accommodate the current market price and their workers' remunerations. A Building Contractor also explained that they resorted to doing overtime and night shift as a strategy to cope with the challenges of shortage in their operation time. This was as a result of their meetings with key stakeholders.

4.2 Discussion of findings

Based on the thematic analysis, the findings were categorized into themes and sub-themes which are all discussed below. For the challenges encountered by Stakeholders, this category revealed two (2) major themes and (9) nine sub-themes with the result showing that Stakeholders encountered two-level challenges: operational and financial as a result of the COVID-19 pandemic. The study details six specific sub-themes under the operational challenges on construction projects:

- 1) Increased price of materials
- 2) Health and safety issues
- 3) Shortage of labour supply
- 4) Delay in project delivery
- 5) Inadequate supply of materials
- 6) Low patronage

The operational site work challenges encountered in construction projects as a result of COVID-19 were attributed to inflation which escalated the price of building materials. This contributed to price increment and resource scarcity experienced by stakeholders. Concerns over health and safety, labour issues such as relocation or withdrawal of personnel were also operational related challenges. This result echoes the assertion of Gamil and Alhagar (2020) that projects that are still running will face challenges such as shortage of workers, the rise of materials price and shortage of material and supply chains. More insights drawn from the findings reveals that, the inability of contractors to move freely due to restriction in movement reduced the efficiency of the workers on the worksite, making labour and material supply along with project supervision difficult. This result agrees with previous work by Alsharef et al. (2021) that COVID-19 impacted material delivery delays, workforce shortages, reduction in efficiency and production rate, slowing on-going and new projects.

Another illuminating finding from the study shows that the issue of low patronage, difficulties in recruiting skilled and unskilled labour, low workforce due to relocation and withdrawal of construction workers are social sustainability themes established in this study. This finding lends credence to Pamidimukkala and Kermanshachi (2021) that labour impact, concerns about job stability and job loss are factors caused by COVID-19. By implication, this proves that the social aspect of sustainability was adversely impacted during the COVID-19 pandemic in the Nigerian construction sector.

Furthermore, three sub-themes under financial challenges encountered by stakeholders due to COVID-19 were revealed as:

- 1) Increase in materials and construction cost
- 2) Reduction in profit
- 3) Payment delays

Undoubtedly, financial difficulty is a major economic challenge experienced as a result of the pandemic. As such, findings from the study prove that stakeholders experienced little or no profit. Delayed payments further affected the contractor's cash flow in the project. Also, the study reveals that increase in the cost of human and material resources on the site, along with increase in construction cost, were challenges experienced by stakeholders. This finding is consistent with Osuizugbo (2020) and Yusuf et al. (2021) that high cost of construction materials and additional cost are among the effects of COVID-19 in the Nigerian construction sector. This infers that during the COVID-19 pandemic, the economic aspect of sustainability in Nigeria was seriously affected. Figure 2 presents a flow chart of the challenges encountered in construction projects during COVID-19 pandemic.

The study further developed strategies to address these challenges. As a result of the thematically analyzed findings, three (3) themes and twelve (12) sub-themes were derived. Managerial, governmental and stakeholders' strategies were developed to achieve sustainable project delivery. Under managerial strategies, the eight subthemes were:

- 1) Clear communication strategy and team collaboration
- 2) Centralization of data
- 3) Efficient and effective monitoring
- 4) Risk management
- 5) Agile project management
- 6) Taking market survey and bulky purchase
- 7) Promotion of health and safety
- 8) Application of technological innovation

The result of this study reveals that training construction workers on being health and safety conscious, provision of hand sanitizers and nose mask are among the health and safety strategy employed in construction projects. This shows that stakeholders promoted continuous health and safety improvement and adhered to COVID-19 protocols at construction sites. This finding is in agreement with previous studies by Permesly et al. (2021) that safe work site conditions, provision for hand washing and sanitizers, and the use of face masks are measures to address COVID-19 challenges. This can be deduced as an environmental aspect of sustainable construction, indicating that stakeholders are applying sustainability goals to achieve sustainable project delivery. Another profound finding from this study reveals that monitoring material cost through market survey and bulk purchase is a key strategy employed by Contractors to address the increase in material cost. This strategy assists in improving project cost overrun in stakeholder's quest for sustainable project delivery. Also, management's strategy in exploring remote working technologies such as Microsoft office and Zoom video conferencing have been revealed as a strategy to achieve sustainable project delivery in a non-Covid world. This finding conforms to the observation of Ogunnusi et al. (2020) that, construction companies that are adopting and implementing technology, especially in this COVID-19, will have better collaboration and increased productivity. This shows the benefits to be had in applying technological innovation for sustainable project delivery in the US.

Two sub-themes under governmental strategies were also revealed:

- a) Government relief funds and loans
- b) Provision of incentives for worker

The role of the government in providing relief funds and loans can go a long way in sustaining stakeholders during the post-Covid period. Therefore, findings from this study support the call for the provision of financial aid by the government and clients in the form of relief funds and loans. This can take the form of introducing incentive and overtime for workers to assist contractors in operation, paying staff salaries and supporting the project cost. This is in tandem with Osuizugbo (2020) and Isang and Ebiloma (2022) that adequate funding and social welfare packages can swiftly cushion the effect of the pandemic in Nigeria. This implies that going forward; the US construction sector must fully utilize the economic aspect of sustainability in the post-Covid era for sustainable project delivery.

Two sub-themes under stakeholder's engagement strategies to address COVID-19 were also revealed to include:

- a) Timely project delivery within the budget
- b) Adequate supervision

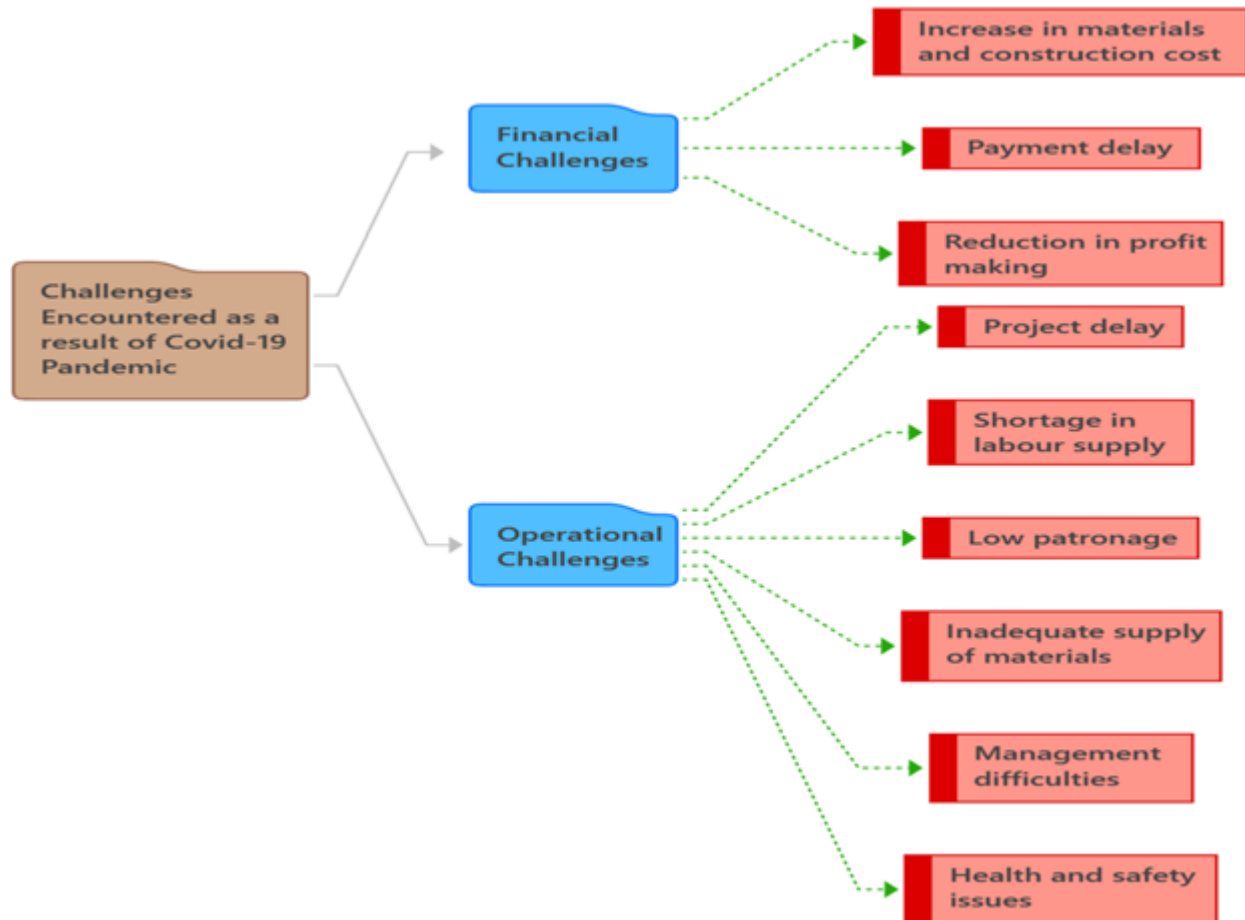


Figure 2: Flow chart of the specific challenges encountered by Project managers and stakeholders in US as a result of the COVID-19 pandemic on construction projects.

5. Conclusion

The impact of the COVID-19 pandemic has challenged in countries in the global north such as the US in terms of project delivery in the construction sector. It is on this basis; this research examined the challenges encountered by Project managers and other stakeholders during COVID-19 and developed strategies to achieve sustainable project delivery during this period of uncertainty, see Figure 3.

Findings from the study showed that Project managers and stakeholders in the US are encountering operational and financial challenges due to COVID-19. The study showed that construction project managers were affected by increase in the price of materials, health and safety issues, shortage of labour and material supply, reduced profit, and delays in project. This emphasizes the need to carry out market survey and bulk purchase for cost savings. The introduction of overtime work, night shift and worker's remuneration have also been shown to assist stakeholders in addressing labour impact to achieve effective project delivery. Also, the study indicates that, in order to tackle COVID-19 challenges,

project managers and stakeholders are employing managerial, governmental and stakeholder's strategies. At management level, more attention is now focused on improving the health and safety of construction workers as a result of COVID-19. The study further reiterates the need for government and clients to provide loan, funding and incentives to assist Project managers and other stakeholders in supporting staff payment and exceeding cost towards project completion. The key to achieve this is by introducing incentives programs, overtime, and grants.

Based on these findings, the study thematically drew the conclusion that COVID-19 have caused operational and financial challenges; as a result, it is advised that managerial, governmental, and stakeholder strategies be used to achieve effective project delivery during period of uncertainty in the US. Adaptability, communication, and flexibility are also advised for project managers as they approach handling projects in uncertain times. The research also highlights how important stakeholder engagement, contingency planning, and leadership are to managing projects during uncertain times.

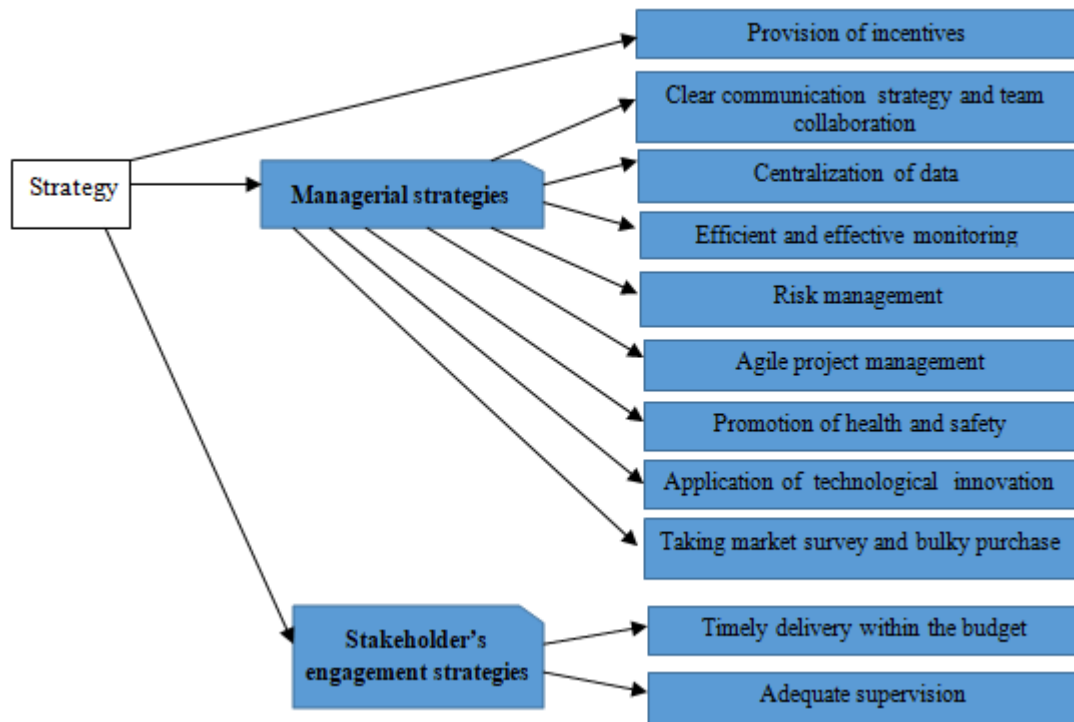


Figure 3: Flow chart of the applicable strategies developed to be employed by Project managers during period of uncertainty in the US.

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